BASALT: Biologic Analog Science Associated with Lava Terrains

Completed Technology Project (2015 - 2019)

Project Introduction

The BASALT (Biologic Analog Science Associated with Lava Terrains) program will investigate terrestrial volcanic terrains and their habitability as analog environments for early and present-day Mars. We will conduct our scientific fieldwork under simulated Mars mission constraints to evaluate strategically selected concepts of operations (ConOps) and capabilities with respect to their anticipated value for the joint human and robotic exploration of Mars. BASALT offers fidelity to PSTAR in the areas of Science, Science Operations, and Technology. Programmatically, we directly address the PSTAR interests by enabling integrated interdisciplinary field experiments focused on exploring relevant environments on Earth as an integral part of preparation for future human missions to Mars. Specifically, our science-driven exploration program is expected to result in new scientific, operational and technological capabilities that will serve to enable and inform the next generation of human-robotic planetary exploration. a) Science: The BASALT science program is focused on understanding habitability conditions of early and present-day Mars in two relevant Mars-analog locations (the Southwest Rift Zone (SWRZ) and the East Rift Zone (ERZ) flows on the Big Island of Hawai'i and the eastern Snake River Plain (ESRP) in Idaho) to characterize and compare the physical and geochemical conditions of life in these environments and to learn how to seek, identify, and characterize life and life-related chemistry during these two epochs of martian history. b) Science Operations: The BASALT team will conduct real (non-simulated) biological and geological science at two high-fidelity Mars analogs, all within simulated Mars mission conditions (including communication latencies and bandwidth constraints) that are based on current architectural assumptions for Mars exploration missions. We will identify which human-robotic ConOps and supporting capabilities enable science return and discovery. c) Technology: BASALT will incorporate and evaluate technologies in to our field operations that are directly relevant to conducting the scientific investigations regarding life and life-related chemistry in Mars-analogous terrestrial environments. BASALT technologies include the use of mobile science platforms, extravehicular informatics, display technologies, communication & navigation packages, remote sensing, advanced science mission planning tools, and scientifically-relevant instrument packages to achieve the project goals. Perceived Significance: Our proposed work will significantly impact and contribute to the state of knowledge in a) the habitability potential of diverse Mars analog basalts, and b) how to efficiently, productively and safely conduct field science with human explorers. Scientific data derived from our two complementary field sites will provide a foundational understanding of the habitability of distinct geochemical, mineralogical and textural properties associated with Mars-like terrestrial basalts. It is anticipated that the results from our field-based research will result in numerous conference and peer-reviewed publications, as a consequence of the experience of our science team and breadth of our proposed research. Furthermore, many of the proposal team members are Principal Investigators of other related habitability studies, Mars missions, and

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Planetary Science and Technology Through Analog Research

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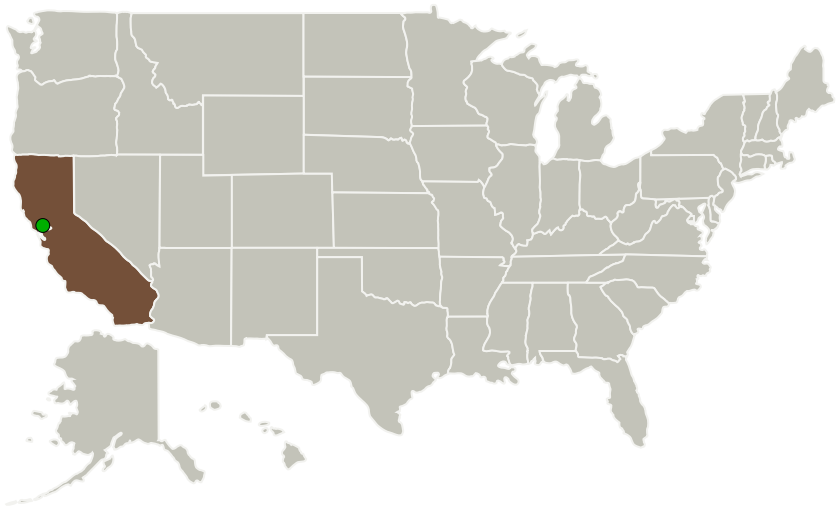
NASA exploration analogs, and are directly involved in NASA's Human Architecture Team (HAT). As such, the learning from our proposed work will undoubtedly, as has happened in the past, inform and leverage analog testing and mission development on those areas, and vice-versa. Another unique contribution of our work will be an evaluation of how our ConOps and capabilities compare in their ability to support geological versus biological field approaches.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Management

Program Director:
Carolyn R Mercer

Program Manager:
Sarah K Noble

Principal Investigator:
Darlene S Lim

Co-Investigator:
Sandra Owen

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.4 Surface Mobility

Target Destination

Others Inside the Solar System